

Application Serial No.: 10/608,733
Amendment dated November 2, 2004
Reply to Office Action of August 13, 2004

REMARKS/ARGUMENTS

The Office Action dated August 13, 2004 and the references cited therein have been carefully considered. In response to the Office Action, Applicants have amended Claims 1, 8, 15 and 21 and have canceled Claims 2, 9, 16 and 25 which, when considered with the remarks set forth below, is deemed to place the case in condition for allowance.

Additionally, a Declaration under 37 C.F.R. § 1.132 from the inventor, Dr. Laura J. Henderson Lewis, accompanies this Amendment. As a result of the present Amendment, Claims 1, 3-8, 10-15 and 17-24 remain in the case for continued prosecution.

In the Office Action, Claims 1-7 and 15-25 have been rejected under 35 U.S.C. § 102(a) as being anticipated by the Lewis et al article cited in Applicant's IDS. Claims 1, 3-8, 10-15 and 17-24 have also been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,985,072 to Sahashi et al. and Claims 2, 9, 16 and 25 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Sahashi et al. patent in view of U.S. Patent No. 5,743,095 to Gschneidner Jr. et al.

It is first noted that the Lewis et al article, cited in the Office Action as a basis for a claim rejection under 35 U.S.C. § 102(a), bears a publication date of July 21, 2003, which is *after* the June 30, 2003 filing date of the present application. Therefore, the Lewis et al article can not be used as a grounds for a prior art rejection under 35 U.S.C. § 102(a). Accordingly, it is respectfully requested that the prior art claim rejections based on the Lewis et al article be withdrawn.

With respect to the remaining claim rejections, Applicant has amended Claims 1, 8, 15 and 21 to define a magnetocaloric effect heterostructure having a $Gd_5(Si_{1-x}Ge_x)_4$ material core. This feature was previously found in dependent Claims 2, 9, 16 and 25. Accordingly, these claims have been cancelled. It is respectfully submitted that neither the Sahashi patent nor the Gschneidner patent, taken alone or combined, discloses a magnetocaloric effect heterostructure having a core made of $Gd_5(Si_{1-x}Ge_x)_4$ and an elastically stiff material layer coated on at least one surface of the core to restrict volume changes of the core during application of a magnetic field.

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In particular, the Sahashi patent is directed to a polycrystalline magnetic substance for magnetic refrigeration. The substance is a compact that consists of powders of a magnetic alloy that includes at least one rare earth element. It is stated that the powder particles may be coated with a layer of Ni, Co or Fe.

First, as noted by the Examiner, there is no teaching or suggestion in the Sahashi patent of using a $Gd_5(Si_{1-x} Ge_x)_4$ material for a magnetocaloric core. Instead, the Sahashi patent only discloses use of rare earth elements for use as a magnetocaloric core. It is noted that these materials generally do not exhibit volume changes upon application of a magnetic field, as does a $Gd_5(Si_{1-x} Ge_x)_4$ compound. (See the attached Declaration of the inventor, Dr. Laura J. Henderson Lewis.) Thus, the Sahashi patent is directed to an entirely different magnetic refrigeration material consisting of rare earth powders disposed in a binder to enhance the heat conduction property of the compact. (See column 6, lines 18-29 of the Sahashi patent.) More significantly, enhancing the magnetocaloric effect of a $Gd_5(Si_{1-x} Ge_x)_4$ compound is not disclosed in the Sahashi patent.

Second, it is stated in the Sahashi patent that a coating of Ni, Co or Fe may be utilized as an intermediate layer only to prevent the non-magnetic binder from coming into contact and diffusing into the inner rare earth element core. (See column 11, lines 1-10 of the Sahashi patent.) There is absolutely no mention in the Sahashi patent of the Ni, Co or Fe intermediate layer restricting volume changes of the core, as defined in independent Claims 1, 8, 15 and 21, as amended. Indeed, as mentioned above, the core materials disclosed in the Sahashi patent do not change in volume under the application of a magnetic field and, therefore, one skilled in the art would not be motivated by the teachings of the Sahashi patent to provide such a volume restricting feature to a coating layer.

While the Gschneidner patent discloses various forms of $Gd_5(Si_{1-x} Ge_x)_4$ compounds for use as a magnetic refrigerant, there is absolutely no teaching or suggestion of enhancing the magnetocaloric effect of such compounds by restricting their volume changes during application of a magnetic field. Instead, the Gschneidner patent focuses solely on optimizing the magnetocaloric effect properties of these refrigerants by adding magnetically-soft

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alloying elements to produce a single phase, homogenous compound. The Gschneidner patent does not teach or suggest coating or laminating a thin layer of elastically stiff material to a $Gd_5(Si_{1-x}Ge_x)_4$ compound core in order to restrict volume changes to the core that result from the application of a magnetic field.

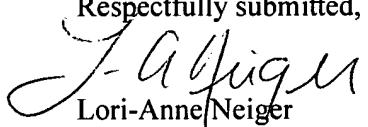
Moreover, contrary to the Examiner's assertion, it would not have been obvious to one of ordinary skill in the art to modify the magnetic cooling system of the Sahashi patent by using a $Gd_5(Si_{1-x}Ge_x)_4$ compound as taught by the Gschneidner patent. In particular, the Gschneidner patent stresses the importance of a single phase material for use as the magnetocaloric effect refrigerant. (See, e.g., column 10, lines 6-10.) Thus, the Gschneidner patent expressly teaches away from coating a magnetocaloric material to produce a heterostructure, as taught by Sahashi, and therefore, there is absolutely no motivation to combine the teachings of these two patents.

Furthermore, as set forth above, neither patent discusses volume changes of a magnetocaloric compound, let alone the benefits of restricting volume changes of such a material. Accordingly, even if one skilled in the art were somehow motivated to coat the $Gd_5(Si_{1-x}Ge_x)_4$ compound, as taught by the Gschneidner patent, with a Ni, Co or Fe intermediate layer, as taught by the Sahashi patent, the result would not necessarily be the same as the claimed invention, since neither patent discloses the importance of providing a volume restricting coating layer.

Accordingly, for all the foregoing reasons, it is respectfully submitted that independent Claims 1, 8, 15 and 21 as amended, and the Claims that depend therefrom patentably distinguish over the Sahashi et al. patent and the Gschneidner Jr. et al. patent, taken alone and combined.

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In view of the foregoing amendment and remarks, favorable consideration and allowance of the application with Claims 1, 3-8, 10-15 and 17-24 are respectfully solicited. If the Examiner believes that a telephone interview would assist in moving the application toward allowance, he is respectfully invited to contact the Applicant's attorney at the telephone number listed below.

Respectfully submitted,

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